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several cross classifications which we shall have to employ. It will also be necessary to see whether these symbols cannot be placed in a less conspicuous place on the cards. This is not so easy as would at first appear, for it must be remembered that the same type must be used for the pamphlet edition.

I have now passed the more important notes in review, hoping that this may facilitate future correspondence. Permit me to state, in closing, that I should be delighted to receive further suggestions in this regard. I must beg, however, some indulgence if I should find myself unable to reply promptly to all friends of the undertaking; the correspondence has already assumed such proportions that it is almost impossible to attend to it single-handed.

HERBERT HAVILAND FIELD.

THE DOGMATISM OF SCIENCE.

TO THE EDITOR OF SCIENCE—*Sir*: "The hardest of intellectual virtues is philosophic doubt," it has been said, and viewing the statements and the facts, one is inclined sometimes to assent to it in a literal way, *i. e.*, as an unintentional statement of the hardness, density or impenetrability of much that passes under the name of philosophic doubt. By the words, however, it is supposably meant that this 'philosophic doubt' is a virtue above all others, and that it is only the extremely virtuous who may ever reach this lofty pinnacle of greatness. To this I demur. As Heine said: We are natural protestants, and certainly the spirit that denies, *der Geist der stets verneint*, is as a matter of fact the easiest and the most common of 'virtues,' though Goethe and humanity have agreed in personalizing it as distinctly Mephistophelean, rather than angelic, or even manly. I should add that "the mental vice to which we are most prone is our tendency to assume that" our *Verneinung* in the name of science of all the religious and poetical truths that have been gained by humanity has anything virtuous or logical or scientific about it.

As to what is virtue, intellectual or moral, and as to what may be logical, there will never be an end of discussion, but as to what is scientific there should nowadays be convictions so indubitable that discussion should end. Even

the typical scientific dogmatist must admit that science properly considered is the unprejudiced, colorless observation of facts and the inductions from these facts *only so far as the facts will carry*. But the fundamental thesis of a certain class of scientists is that biologic facts are all explainable by the forces of 'mechanical energy and physical matter.' To ordinary—what I should call normal or healthy—minds, this is as perfect an example of deduction, theory or dogmatism as could be stated. So long as the old materialistic bauble of spontaneous generation remains the the veriest will-o-the-wisp, the most undemonstrated and undemonstrable absurdity, so long have these 'scientists' not a shred or shadow of evidence that their dogma has any genuine scientific basis. For every biologic fact there must be posited the unexplained, and so far in-explainable fact of life itself, of sentience, or 'sensitive' or 'irritable' protoplasm, as the very beginning of the fact. To say in advance that this life, sensitiveness, irritability, etc., is explainable upon the principles or forces of physics is in most absolute contradiction of the scientific spirit, and one who dogmatically asserts it has yet to learn the a b c of scientific method. The scientist who thus commits scientific suicide may charitably be excused on the ground that he is a victim of the subtle laws of psychologic heredity, that he is an 18th century atheist masquerading as scientist, one with a dissident dogma unwarrantably compelling science to a service from which she must instinctively rebel.

In a recent letter to SCIENCE Professor Brooks pathetically pleads for a united front of all scientists against the 'Vitalists,' and that the 'dogmatism of biologists' must be attacked at both ends of the line. This rallying cry for unanimity of utterance rather than for adherence to personal conviction is sadly suggestive. It would seem that a more 'virtuous' ideal would be that of following truth rather than partisanship. 'Failure to agree' is stigmatized, but it might be politic to first ask who are the disagreeers. The answer to that question might result in the finding that Professor Brooks and his party are the disagreeers or sectarians, because if my observation is correct the scorned vitalists, as Professor Gage avers, constitute the

immense majority of scientific workers, and the few materialists who presume to speak in the name of their scientific brethren have no brief so to represent them. The cool assumption that biologic science is coterminous with physics is difficult to correctly characterize—politely. The refutation of that dogma has been made a hundred times and no adequate answer to these refutations has ever been made. Take one of these refutations, Beale's *Protoplasm*; no dispassionate and logical mind, knowing aught of the history of science or the laws of logic, can deny that the arguments and facts there set forth leave the dogmas of scientific materialism smashed to utter and everlasting smithereens.

An amusing corollary of the scientific dogmatists is that "consciousness and volition cannot cause structure or anything else," and that function is always the result of structure. This is, of course, necessary to the materialistic dogma, but "it can be stated without fear of refutation" that no one, not even Professor Brooks, ever observed a single fact of physiology, plant or animal, in which function did not precede structure, and surely before he could write his denial his 'consciousness and volition' set to work the machinery that moved his pen. Are the pseudopods of the *amœba* 'structures?' Did not the function of *amœboid* locomotion precede the locomotion of truly structural organs, such as feet and fins? Did not the desire for movement precede *amœboid* movement? Did not the desire create the structureless pseudopods? If function is always the result of structure, what then created the structures, *e. g.*, the million structures of the unborn fetus? The logic of the situation is that as 'consciousness and volition' have no organs, so far as any scientist knows, of which they are the outcome, it follows that consciousness and volition are only 'the empty shadow of changes that go on in the physical basis'—*i. e.*, they do not exist. If the facts do not tally with our theory so much the worse for the facts—let's flatly deny them existence. Of 'beliefs held because they cannot be disproved,' the most perfect of illustrators are surely those children in science who dogmatically wage Quixotic warfare against dogmatism.

Of the many charming self-contradictions of

Professor Brooks' delightful letter that I should like to mention, none is more suggestive than his 'demand' that we accept as our sole scientific creed the desire to find out "whether life is or is not different from matter," and "whether thought is or is not an agent," and yet the beginning, middle and end of his entire letter is, one might say, soaked in the dogma, determined in advance, that there is no 'whether' at all, and that it 'is flatly contradicted by most investigators.' His contempt for those who still entertain the 'whether' is,—to put it most courteously—the limit of childish *naïveté*.

GEORGE M. GOULD.

PHILADELPHIA, October 15, 1895.

THE INVERTED IMAGE ON THE RETINA AGAIN.

PROFESSOR BROOKS' statement concerning the inverted image on the retina, in a late number of *SCIENCE*, has called to my mind an experiment in optics which I stumbled upon as a boy one Sunday night in church when the sermon had extended beyond my powers of listening. As I have not seen an account of the experiment in the usual statements regarding the demonstration of the inverted image on the retina, I venture to give the matter for whatever it may be worth.

My attention having been attracted by the 'beams' of light which seemed to shoot off towards the ceiling and toward the floor from one of the gas jets of a chandelier, I aimlessly pushed against the *under* eyelid with my finger, and was surprised to see one of the beams of light, the *upper* one, shorten and lengthen, according to whether I opened or shut the lower lid. On repeating the experiment with the *upper* lid, I obtained the same results on the beam which appeared to pass *downward* from the gas jet. By closing one eye and carefully squinting with the other at the distant gas jet and working my eyelids in the manner above described, it was at once evident that the outer termini of these beams were cut squarely off, and that the end farthest from the gas light was in some way by refraction hinged to the edge of my eyelid. In short, as these red 'rays' formed part of the opposite sides of a cone, with the gas light at their apex, and the base at the contact of the edge of my eyelids